



Published in final edited form as:

Vaccine. 2017 August 03; 35(34): 4346–4354. doi:10.1016/j.vaccine.2017.06.074.

Knowledge of influenza vaccination recommendation and early vaccination uptake during the 2015–16 season among adults aged 18 years – United States

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Abstract

Background—Since 2010, the Advisory Committee on Immunization Practices (ACIP) has recommended that all persons aged 6 months receive annual influenza vaccination.

Methods—We analyzed data from the 2015 National Internet Flu Survey (NIFS), to assess knowledge and awareness of the influenza vaccination recommendation and early influenza vaccination coverage during the 2015–16 season among adults. Predictive marginals from a multivariable logistic regression model were used to identify factors independently associated with adults' knowledge and awareness of the vaccination recommendation and early vaccine uptake during the 2015–16 influenza season.

Results—Among the 3301 respondents aged 18 years, 19.6% indicated knowing that influenza vaccination is recommended for all persons aged 6 months. Of respondents, 62.3% indicated awareness that there was a recommendation for influenza vaccination, but did not indicate correct knowledge of the recommended age group. Overall, 39.9% of adults aged 18 years reported having an influenza vaccination. Age 65 years and older, being female, having a college or higher education, not being in work force, having annual household income \$75,000, reporting having received an influenza vaccination early in the 2015–16 season, having children aged 17 years in the household, and having high-risk conditions were independently associated with a higher correct knowledge of the influenza vaccination recommendation.

Conclusions—Approximately 1 in 5 had correct knowledge of the recommendation that all persons aged 6 months should receive an influenza vaccination annually, with some socio-

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Conflict of interest

All authors have no conflicts of interest to be stated.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of CDC.

economic groups being even less aware. Clinic based education in combination with strategies known to increase uptake of recommended vaccines, such as patient reminder/recall systems and other healthcare system-based interventions are needed to improve vaccination, which could also improve awareness.

Keywords

Influenza; Influenza vaccine; Vaccination; Coverage; Adult; Knowledge of influenza vaccination recommendation; National Internet Flu Survey (NIFS); The Advisory Committee on Immunization; Practices (ACIP)

1. Introduction

Influenza is a major cause of morbidity and mortality among adults in the United States [1–4]. Influenza illness burden among healthy adults 18–49 years is an important cause of outpatient medical visits and loss of workdays [5,6]. Influenza vaccination has been shown to be a cost-effective tool for reducing morbidity and mortality associated with influenza among adults [5,7–18].

Prior to 2010, the adult groups recommended for annual vaccination included persons 50 years and older, pregnant women, persons 18–49 years with medical conditions associated with higher risk of complications from influenza infection, healthcare personnel, and close contacts of high-risk persons [19]. Since the 2010–11 influenza season, the Advisory Committee on Immunization Practices (ACIP) has recommended annual influenza vaccination for all persons 6 months of age and older, including healthy adults 18–49 years who were not close contacts of persons at high-risk [1]. Healthy adults aged 18–49 year was added to the recommendations in the 2010–11 season given the known significant morbidity and economic impact of influenza in working age adults [1]. In addition, the universal vaccination recommendation also eliminates the need to determine whether each person has one or more specific indications for vaccination and emphasizes the importance of preventing influenza among persons of all ages [1].

Influenza vaccination is the most effective strategy for preventing influenza and its complications; however, vaccination coverage has been suboptimal [1,20–22]. Knowledge and awareness of the influenza vaccination recommendation might be related to vaccination coverage [20,23], but information about levels of knowledge and association between knowledge and vaccination among adult population groups is limited.

Data from the 2015 National Internet Flu Survey (NIFS) were analyzed to assess knowledge and awareness of influenza vaccination recommendation and early vaccination during the 2015–16 season among adults aged 18 years in the United States.

2. Methods

The NIFS is an annual survey and collects information about early-season influenza vaccination, and knowledge, attitudes, behaviors, and barriers related to influenza and influenza vaccination in the non-institutionalized U.S. adult population. The 2015 NIFS was

conducted for Centers for Diseases Control and Prevention (CDC) by RTI International and GfK Custom Research, LLC during October 29–November 11, 2015. The survey was conducted using a probability-based Internet panel, the GfK KnowledgePanel, designed to be representative of the non-institutionalized U.S. population 18 years or older[®] [24].

For this ongoing panel, participants are initially chosen by a random selection of telephone numbers and residential addresses. Persons in selected households are then invited by telephone or mail to participate in the web-enabled KnowledgePanel[®]. For those who agree to participate but do not already have Internet access, both a laptop and Internet access are provided at no cost. The laptop was delivered to the residence of the panel members in exchange for members completing a short survey on a weekly basis. The device is theirs to keep if they remain on the panel for three years. Most members are able to install the hardware without additional assistance, although GfK maintains a telephone technical support line and will, when needed, provide on-site installation. Panel members may contact the panel member support department for questions using a toll-free number. Totally, of the 3301 members who completed the survey, 250 were furnished with devices/internet access by GfK. People who already have computers and Internet service participate using their own equipment.

The 2015 NIFS sampling design was a single-stage stratified sample with oversampling of select subgroups of particular analytical interest. Twelve mutually exclusive design strata were defined as the interaction of two categorical variables—*age* (18–49 years, 50–64 years, and 65 years and older) and *race/ethnicity* (Hispanic, non-Hispanic white, non-Hispanic black, and non-Hispanic other/multiple races)—known for all members of the probability-based Internet panel. Independent random samples were selected within each design stratum. A total of 6148 panel members across the 12 design strata were randomly sampled using probabilities of selection inversely proportional to the KnowledgePanel[®] survey weight (a base weight adjusted for nonresponse) from 42,075 eligible panelists, with a target of 4025 completed surveys. A total of 3301 completed the survey, with a completion rate of 53.7% (unweighted), and 57.6% (weighted).

In the 2015 NIFS, a new question was added to the survey regarding knowledge of the influenza vaccination recommendation that all persons age 6 months and older be vaccinated.

Respondents were asked: “Who do you believe the flu vaccine is recommended for?” The potential answers to the question included: (1) all persons age 13 years and older; (2) only adults age 18 years and older with chronic medical conditions; (3) all persons age 6 years and older; (4) all persons age 6 months and older; (5) persons of any age; (6) none of the above; (7) don’t know. Individuals could select only one response to this question. Persons who stated “(4) all persons age 6 months and older” were considered to have correct knowledge of the influenza vaccination recommendation. Respondents who answered either “(1) all persons age 13 years and older” or “(2) only adults age 18 years and older with chronic medical conditions” or “(3) all persons age 6 years and older” or “(5) persons of any age” were considered to have awareness that there was a recommendation for influenza vaccination, but not the correct knowledge of the recommended age group. Persons who

stated either “(6) none of the above” or “(7) don’t know” were considered to have neither knowledge nor awareness of the influenza vaccination recommendation.

To determine influenza vaccination coverage, respondents were asked: “Since July 1, 2015, have you had flu vaccination?” and individuals were considered to have received an influenza vaccination if they reported having received the vaccine since July 1, 2015. Influenza vaccination coverage estimates represent approximately the cumulative proportion of persons vaccinated by the time the survey was conducted [21]. Metropolitan Statistical Areas (MSA) status is categorized as metro and non-metro. Metro includes anyone in a metropolitan areas (having at least one urbanized area of 50,000 or more population plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties) or micropolitan areas (having at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties). Non-metro includes anyone living outside of both a metropolitan and micropolitan area.

SAS release 9.3 (SAS Inc. Cary, NC) and SUDAAN 11.0 (RTI, Research Triangle Park, NC) were used to calculate point estimates and 95% confidence intervals for knowledge or awareness of the influenza vaccination recommendation, and early season influenza vaccination coverage. *T*-tests were used to test for differences in knowledge or awareness of the influenza vaccination recommendation, neither knowledge nor awareness of influenza vaccination recommendation, and vaccination coverage and for each variable. A two-sided significance level of 0.05 was adopted for all statistical tests. All percentages in the tables were weighted estimates and the tests were conducted based on the weighted estimates. Multivariable logistic regression models with predictive marginals were used to identify factors independently associated with knowledge or awareness of the influenza vaccination recommendation, neither knowledge nor awareness of influenza vaccination recommendation, and influenza vaccination coverage among adult populations. We did *t*-tests for each variable within each column, and the reference group for each variable within each column is shown in Table 4. Independent variables in the models which may be associated with vaccination or awareness of recommendation were selected based on previous studies [20,22–23].

3. Results

Sociodemographic and access-to-care characteristics of the study population are shown in Table 1.

Among all adults aged 18 years, only 19.6% indicated correct knowledge of the influenza vaccination recommendation (those who answered that “the vaccine is recommended for all persons age 6 months and older”) (Table 2). Among those indicating correct knowledge of the influenza vaccination recommendation, influenza vaccination coverage was 53.5%, significantly higher than those with incorrect answers including, “only adults age 18 years and older with chronic medical conditions” (33.4%); “all persons age 6 years and older” (40.1%); “persons of any age” (39.4%); “none of the above” (16.6%); and “don’t know” (23.3%) (Table 2).

In bi-variable analyses (Table 3), 62.3% reported being aware that influenza vaccination is recommended, and 18.1% reported having neither knowledge nor awareness of recommendation. Knowledge of the correct influenza vaccination recommendation was significantly higher (26.8%) among those who received vaccination compared with those who had not (15.4%) (Table 3). Overall, 39.9% of adults aged 18 years reported having an influenza vaccination by the date they completed the NIFS interview. The following factors were significantly associated with a higher level of correct knowledge of the influenza vaccination recommendation: age 65 years, being female, having a college or higher education, not being in the workforce, household income \$50,000, reporting having received an influenza vaccination early in the 2015–16 season, having children aged 17 years in the household, and having high-risk conditions (Table 3). Being in the 50–64 years age group, non-Hispanic black race/ethnicity, and never having been married were significantly associated with a lower level of correct knowledge of the influenza vaccination recommendation. Having children aged 17 years in the household was the common factor that was significantly associated with correct knowledge, awareness, and neither knowledge nor awareness of influenza vaccination recommendation. Other factors that were associated with knowledge or awareness, and neither knowledge nor awareness were shown in Table 3. The following factors were significantly associated with higher influenza vaccination coverage: age 50 years, having a college or higher education, not being in the workforce, indicating correct knowledge of influenza vaccination recommendation, reporting having visited a doctor or healthcare professional since July 1 and having received a recommendation with or without offer for vaccination, and having high-risk conditions. Being of non-Hispanic black race/ethnicity, never having been married, neither having correct knowledge nor awareness of influenza vaccination recommendation, and having children aged 6–17 years in the household were significantly associated with a lower coverage level of influenza vaccination (Table 3).

In multivariable analyses, among adults 18 years, the following factors were significantly associated with a higher level of correct knowledge of influenza vaccination recommendation: age 65 years, being female, having a college or higher education, not being in work force, having annual household income \$75,000, reporting having received an influenza vaccination early in the 2015–16 season, having children aged 17 years in the household, and having one or more high-risk conditions. Being of non-Hispanic black race/ethnicity was significantly associated with a lower level of correct knowledge of influenza vaccination recommendation (Table 4). Having children aged 17 years in the household was the common factor that was significantly associated with correct knowledge, awareness, and neither knowledge nor awareness of influenza vaccination recommendation. Other factors that were associated with awareness and neither knowledge nor awareness were shown in Table 4. Among adults 18 years, the following factors were significantly associated with a higher level of influenza vaccination: age 50 years, having a college or higher education, indicating knowledge of influenza vaccination recommendation, reporting having visited a doctor or healthcare professional since July 1 and having received a recommendation with or without offer for vaccination, and having high-risk conditions (Table 4).

4. Discussion

Less than 1 in 5 adults in the United States had correct knowledge of the ACIP recommendation that all persons aged 6 months should receive an influenza vaccination annually, with some socio-economic groups being even less knowledgeable. However, more than 3 in 5 adults in the United States were aware that there is a recommendation for influenza vaccination, although they did not know the correct recommended age group. Less than half of adults reported vaccination by early November 2015. Since 2010, annual influenza vaccination recommendation has been recommended for all persons 6 months of age and older [1]. To our knowledge, this is the first comprehensive assessment of knowledge of the influenza vaccination recommendation, providing data on associations with the sociodemographic characteristics. Such information can assist efforts to develop strategies to improve knowledge and vaccination coverage among adult populations.

Overall, based on our study, 39.9% of adults aged 18 years reported having an influenza vaccination by the date they completed their survey. Vaccination coverage increases by the end of season; however, increases are limited, since most people receive their vaccination before December with only about 8% of individuals being vaccinated from December through May [21]. Although influenza vaccination was recommended to all adults aged 18 years since 2010–11 season, coverage was low by 2015 based on our study. Increased influenza vaccination coverage among adult populations is needed. Strategies to increase vaccination coverage include assessment of patients' vaccination indications by healthcare providers and routine recommendation and offer of needed vaccines to adults, implementation of client reminder-recall systems, and use of provider reminders for vaccination [22,25–30].

This study showed that age 50 years, having a college or higher education, and having high-risk conditions were significantly associated with influenza vaccination, consistent with other studies [25,26]. Reporting having visited a doctor or healthcare professional and having received a recommendation with or without offer for vaccination were significantly associated with influenza vaccination, suggesting that receiving a recommendation for vaccination from a healthcare provider plays an important role in early season influenza vaccine uptake, and an offer can increase the likelihood of vaccination uptake. Provider reminders can help ensure a provider remembers to recommend vaccination. Additionally, knowledge of the influenza vaccination recommendation was significantly associated with influenza vaccination after controlling for other factors, highlighting the importance of knowledge in efforts to increase vaccination coverage.

Overall, only 19.6% indicated correct knowledge that influenza vaccination is recommended for all persons aged 6 months. This rate is low given that influenza is one of the most common infectious diseases that causes substantial morbidity and mortality among adults in the United States. Additionally, universal influenza vaccination recommendation was widely covered by media when CDC launched the new recommendation in 2010. Furthermore, CDC invests in a national awareness campaign annually to educate the general population about the importance of influenza vaccination through a mix of communication channels and in collaboration with national and grass-root partners (e.g., local faith-based or community-

based organizations who coordinating immunization clinics) who organize influenza promotion activities and events [1,31,32]. Approximately 36.0% of adults answered that “persons of any age” are recommended to receive influenza vaccination, which indicated that some individuals might be confused with the correct recommendation of “all persons aged 6 months”. The lower knowledge of influenza vaccination recommendation observed in this study (19.6%) could be compared with findings from an influenza A (H1N1) 2009 monovalent vaccine (pH1N1 vaccine) study, which also indicated low knowledge of influenza vaccination recommendations [23]. In that study, only 29.5% of recommended adults correctly reported being in the target groups recommended to receive the pH1N1 vaccine, despite comprehensive media coverage in the wake of the influenza A (H1N1) pandemic and distribution of the pH1N1 vaccine [23]. Several characteristics were independently associated with correct knowledge or awareness of the influenza vaccination recommendation after controlling for other factors. Both female gender and higher education were associated with correct knowledge, which is consistent with previous studies [33–39]. This findings are important for identifying intervention programs to improve awareness among those groups. Efforts to better educate men and those with lower levels of education about influenza vaccination recommendation might improve vaccination.

Having children aged 17 years in the household was associated with knowledge of the correct influenza vaccination recommendation. Adults without children in the households might pay less attention to the details of influenza vaccination recommendations and focus on and remember what applies to themselves. Adults with children in the household have more contact with healthcare providers, and in general have more opportunities to discuss vaccination recommendations with providers, and provider recommendation has been previously shown to influence vaccine uptake [40–43], which might explain the observed association between having children in the household with correct knowledge of the influenza vaccination recommendation. In addition, adults with children, especially small children in the household are likely to have an increased uptake of influenza vaccination to protect their children.

Fewer Non-Hispanic black adults had correct knowledge of the influenza vaccination recommendation compared with non-Hispanic white adults. Similar significant racial/ethnic differences among adults in knowledge of other recommended vaccines such as herpes zoster vaccination [44] and human papillomavirus vaccination have been previously reported [36,39,45,46]. This finding might reflect lower prevalence of vaccination services being offered to black patients, and lower knowledge levels can limit the ability of patients to request vaccination when appropriate [36,39,45,46]. A lack of knowledge regarding recommended vaccinations could translate into a missed opportunity for protection against vaccine preventable diseases. Since patients may not seek vaccination services, each provider visit, including non-routine visits, is a critical opportunity to ensure provider implementation of vaccination services, assessing vaccination needs and recommending necessary adult vaccines to protect adult patients and improve coverage. Clinic based education in combination with strategies known to increase uptake of recommended vaccines, such as patient reminder/recall systems and other healthcare system-based interventions are needed to improve vaccination, which could also improve awareness.

Having received an influenza vaccination early in the 2015–16 season was independently associated with correct knowledge of the influenza vaccination recommendation, indicating that vaccination coverage might be related to knowledge of the recommendation. Additionally, among those who answered “None of the above (listed answers)” or “Don’t know” had particularly lower influenza vaccination coverage (16.6%, and 23.3%, respectively), indicating that lack of knowledge and awareness of the recommendation is related to lower vaccination coverage. In addition, our study showed that more persons with high-risk conditions had correct knowledge of the influenza vaccination recommendation compared to persons without a high-risk condition. Persons with high-risk conditions have more frequent physician contact and more opportunities to discuss their health status and vaccination indications with their providers. Future interventions targeting healthcare providers could help increase influenza vaccine acceptability and uptake. For example, physician vaccination reminder systems may help increase vaccination coverage but are underused by healthcare providers [47,48].

The findings in this study are subject to two limitations. Data for this study were collected by self-report and vaccination was not verified by medical records and may be subject to recall bias [49]. Estimates based on self-report may over or underestimate vaccination coverage. However, self-reported influenza vaccination status among adults has been shown to be sensitive and specific with vaccination status ascertained from medical records [50]. Second, NIFS is an Internet panel survey and although the Internet panel was probability-based, the estimates may not represent all adults in the United States (for example, the response rate is 57.6% and non-responders existed, and the institutionalized adult populations were excluded from the survey), and bias may remain after the weighting adjustments [51]. This limitation may over- or under-estimate vaccination coverage. Third, the representativeness of the respondents which appear to make up of a considerably high number of non-Hispanic white only, household income \$75,000, and living in the South, which may also have impact on our results. Finally, this findings is based on a single year survey only, monitoring the future knowledge and coverage levels are necessary.

Overall, less than half of adults reported vaccination by early November. Five years have passed since ACIP recommended annual influenza vaccination in the 2010–11 season to all persons aged 6 months, only less than 1 in 5 adults in the United States had knowledge of this influenza vaccination recommendation in 2015, with some socio-economic groups being even less knowledgeable. Increasing demand for vaccinations through client reminder and recall systems or clinic-based education with expanded access across all healthcare settings, including pharmacies, may help improve knowledge of influenza vaccination recommendation and increase vaccination coverage [28,52].

Acknowledgments

We thank James A. Singleton and Stacie M. Greby for their thoughtful review of the manuscript.

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Table 1

Demographic characteristics of adults aged 18 years and older, United States, National Internet Flu Survey 2015.

Characteristic	Sample Size, N ^a	Weighted Percentage, %
Total	3301	100.0
Age		
18–49 years	1508	54.7
50–64 years	1033	26.0
65 years and older	760	19.3
Gender		
Male	1622	48.3
Female	1679	51.7
Race/ethnicity		
Non-Hispanic white only	1922	65.5
Non-Hispanic black only	494	11.8
Hispanic	460	14.1
Non-Hispanic, other or multiple races	425	8.6
Marital status		
Married/living with partner	1950	57.9
Widowed/divorced/separated	616	17.7
Never married	735	24.5
Education level		
High school or less	1161	41.4
Some college	956	28.5
College degree or higher	1184	30.1
Employment		
Employed	1862	58.5
Unemployed	188	6.3
Not in work force	1251	35.2
Annual income^b		
<\$35,000	945	27.2
\$35,000–\$49,999	374	11.6
\$50,000–\$74,999	628	17.9
\$75,000+	1354	43.3
Region of residence		
Northeast	590	18.1
Midwest	693	21.4
South	1185	37.1
West	833	23.4
Received an influenza vaccination		
Yes	1354	39.9

Characteristic	Sample Size, N ^a	Weighted Percentage, %
No	1894	60.1
Knowledge/awareness of recommendation for influenza vaccination		
Correct knowledge ^c of recommendation	645	19.6
Awareness ^d of recommendation	2048	62.3
Neither knowledge nor awareness of recommendation	585	18.1
Visit to healthcare professional/received recommendation/offer for flu vaccination		
Doctor visit/received recommendation/offered flu vaccination	661	19.7
Doctor visit/received recommendation/not offered flu vaccination	268	7.9
Doctor visit/not received recommendation/not offered flu vaccination	845	28.5
Did not visit doctor or healthcare professional	1229	43.9
Metropolitan statistical area status		
Metro	2885	85.0
Non-metro	416	15.0
Children in household		
No Children	2432	71.2
Children aged < 5 years	175	5.6
Children aged 6–17 years	694	23.2
High-risk condition status^e		
With high-risk conditions	1079	30.5
Without high-risk conditions	2222	69.5

^aUnweighted sample size.

^bAnnual household income.

^cAdults who answered “all persons age 6 months and older” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have correct knowledge about the ACIP recommendation for influenza vaccination.

^dAdults who answered either “all persons age 13 years and older” or “only adults age 18 and older with chronic medical conditions” or “all persons age 6 years and older” or “persons of any age” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have awareness that there was a recommendation for influenza vaccination, but did not indicate correct knowledge of the recommended age group.

^eAdults were considered having a high-risk condition if they had ever been told by a doctor or other health professional that they had chronic asthma, a lung condition other than asthma, diabetes, heart disease (other than high blood pressure, heart murmur, or mitral valve prolapse), a kidney condition, a liver condition, obesity, sickle cell anemia or other anemia, a neurologic or neuromuscular condition that makes it difficult to cough, or a weakened immune system caused by chronic illness or by medicines taken for chronic illness such as cancer, chemotherapy, HIV/AIDS, steroids, and transplant medicines.

Table 2

Influenza vaccination coverage and population distribution of responses to a question about knowledge of the influenza vaccination recommendation among adults aged 18 years by age group, United States, National Internet Flu Survey 2015.

Answer Responses	Sample Size	Weighted Percentage	Influenza Vaccination Coverage	Age Group		
				18–49 years N (%)	50–64 years, N (%)	65 years, N (%)
Total	3301	100.0	39.9	1508 (54.7)	1033 (26.0)	760 (19.3)
Who do you believe flu vaccine is recommended for						
All persons age 13 years and older	367	11.2	47.7	157 (10.9)	122 (12.3)	88 (10.6) ^b
Only adults age 18 and older with chronic medical conditions	146	4.5	33.4 ^c	56 (4.0)	66 (6.4)	24 (3.4)
All persons age 6 years and older	356	10.5	40.1 ^c	157 (10.5)	112 (10.4)	87 (10.6)
All persons age 6 months and older	645	19.6	53.6	299 (19.4)	160 (15.9)	186 (25.2)
Persons of any age	1179	36.1	39.4 ^c	564 (37.3)	372 (35.6)	243 (33.4)
None of the above	128	3.9	16.6 ^c	71 (4.7)	36 (3.4)	21 (2.5)
Don't know	457	14.2	23.3 ^c	187 (13.1)	160 (16.2)	110 (14.3)

^aUnweighted sample size.

^bp < 0.05 by chi-square test among age groups.

^cp < 0.05 by t-test among those with all other responses compared with those who answered that “the vaccine is recommended for all persons age 6 months and older”.

Table 3

Knowledge and awareness of influenza vaccination recommendation and vaccination coverage among adults 18 years by demographic characteristics - United States, National Internet Flu Survey 2015.

	Knowledge ^a of influenza vaccination recommendation	Awareness ^b of influenza vaccination recommendation	Neither knowledge nor awareness of influenza vaccination recommendation	Early season influenza vaccination coverage
Characteristic	% (95% CI) ^c	% (95% CI)	% (95% CI)	% (95% CI)
Overall	19.6 (18.1, 21.2)	62.3 (60.3, 64.2)	18.1 (16.6, 19.7)	39.9 (38.0, 41.8)
Age				
18–49 years ^d	19.4 (17.2, 21.9)	62.7 (59.7, 65.6)	17.9 (15.6, 20.4)	31.8 (29.1, 34.7)
50–64 years	15.9 (13.5, 18.6)	64.6 (61.2, 67.8)	19.6 (17.0, 22.4)	41.3 (37.9, 44.7)
65 years and older	25.2 (21.9, 28.7)	58.1 (54.1, 61.9)	16.8 (14.0, 20.0)	60.4 (56.4, 64.2)
Gender				
Male ^d	15.4 (13.5, 17.6)	62.6 (59.7, 65.4)	22.0 (19.6, 24.5)	37.9 (35.2, 40.7)
Female	23.5 (21.2, 26.0)	62.0 (59.2, 64.7)	14.5 (12.6, 16.6)	41.7 (38.9, 44.5)
Race/ethnicity				
Non-Hispanic white only ^d	21.5 (19.5, 23.5)	60.1 (57.7, 62.5)	18.4 (16.5, 20.4)	41.6 (39.2, 44.0)
Non-Hispanic black only	13.8 (10.6, 17.7)	67.3 (62.1, 72.1)	18.9 (15.1, 23.4)	35.5 (30.4, 40.9)
Hispanic	17.8 (13.5, 23.2)	65.4 (59.3, 71.1)	16.8 (12.6, 22.0)	36.8 (31.0, 42.9)
Non-Hispanic, other or multiple races	16.2 (11.9, 21.7)	66.9 (60.4, 72.9)	16.8 (12.4, 22.4)	37.9 (31.7, 44.6)
Marital status				
Married/living with partner ^d	22.2 (20.1, 24.4)	61.1 (58.6, 63.7)	16.7 (14.8, 18.8)	42.6 (40.1, 45.1)
Widowed/divorced/separated	21.3 (17.7, 25.4)	61.0 (56.4, 65.5)	17.7 (14.5, 21.4)	46.1 (41.5, 50.9)
Never married	12.3 (9.7, 15.4)	66.0 (61.7, 70.1)	21.7 (18.2, 25.7)	28.6 (24.9, 32.7)
Education level				
High school or less ^d	16.5 (14.1, 19.2)	63.5 (60.2, 66.8)	19.9 (17.3, 22.8)	37.7 (34.5, 41.0)
Some college	18.7 (15.9, 21.8)	62.7 (59.0, 66.3)	18.6 (15.8, 21.8)	35.9 (32.4, 39.5)
College degree or higher	24.7 (22.0, 27.6)	60.2 (56.9, 63.3)	15.1 (13.0, 17.6)	46.6 (43.4, 49.9)
Employment				
Employed ^d	18.7 (16.7, 20.9)	63.1 (60.4, 65.6)	18.3 (16.2, 20.5)	36.2 (33.7, 38.7)
Unemployed	14.1 (8.6, 22.0)	71.6 (63.1, 78.8)	14.3 (9.7, 20.7)	28.7 (21.3, 37.5)
Not in work force	22.1 (19.6, 24.9)	59.4 (56.1, 62.5)	18.5 (16.0, 21.2)	47.9 (44.6, 51.2)
Annual income^e				
<\$35,000 ^d	15.1 (12.6, 18.0)	60.9 (57.0, 64.8)	23.9 (20.6, 27.6)	36.8 (33.0, 40.7)
\$35,000–\$49,999	19.5 (14.9, 25.0)	62.7 (56.6, 68.5)	17.8 (13.6, 22.9)	38.6 (32.8, 44.7)
\$50,000–\$74,999	19.8 (16.4, 23.8)	64.7 (60.1, 69.1)	15.4 (12.3, 19.2)	42.3 (37.8, 46.9)
\$75,000+	22.3 (19.9, 25.0)	62.0 (59.0, 64.9)	15.7 (13.6, 18.0)	41.2 (38.3, 44.1)
Region of residence				
Northeast ^d	18.4 (15.1, 22.3)	65.5 (60.9, 69.8)	16.1 (12.9, 19.9)	41.6 (37.0, 46.4)
Midwest	20.0 (16.8, 23.7)	59.1 (54.8, 63.3)	20.9 (17.6, 24.6)	42.7 (38.5, 46.9)

	Knowledge ^a of influenza vaccination recommendation	Awareness ^b of influenza vaccination recommendation	Neither knowledge nor awareness of influenza vaccination recommendation	Early season influenza vaccination coverage
South	20.8 (18.2, 23.6)	61.6 (58.3, 64.9)	17.6 (15.1, 20.5)	39.6 (36.3, 42.9)
West	18.3 (15.4, 21.7)	63.8 (59.8, 67.7)	17.9 (15.0, 21.2)	36.5 (32.7, 40.5)
Received influenza vaccination				
Yes	26.8 (24.1, 29.6)	63.6 (60.6, 66.6)	9.6 (8.0, 11.6)	NA ^f
No ^d	15.4 (13.6, 17.5)	61.7 (59.0, 64.3)	22.9 (20.7, 25.3)	NA
Knowledge of recommendation for influenza vaccination				
Yes	NA	NA	NA	53.5 (49.0, 58.0)
No ^d	NA	NA	NA	36.5 (34.4, 38.6)
Awareness of recommendation for influenza vaccination				
Yes	NA	NA	NA	40.6 (38.2, 43.1)
No ^d	NA	NA	NA	38.6 (35.5, 41.8)
Neither knowledge nor awareness of recommendation for influenza vaccination				
Yes	NA	NA	NA	21.8 (18.2, 25.9)
No ^d	NA	NA	NA	43.7 (41.6, 45.9)
Visit to healthcare professional/received recommendation/offer for influenza vaccination				
Doctor visit/received recommendation/offered influenza vaccination	20.8 (17.3, 24.8)	66.2 (61.8, 70.4)	13.0 (10.3, 16.4)	64.7 (60.3, 69.0)
Doctor visit/received recommendation/not offered influenza vaccination	21.3 (16.2, 27.3)	64.8 (58.0, 71.0)	14.0 (9.7, 19.6)	47.8 (41.1, 54.6)
Doctor visit/not received recommendation/not offered influenza vaccination	20.5 (17.5, 23.9)	62.5 (58.7, 66.2)	17.0 (14.3, 20.1)	33.4 (29.9, 37.2)
Did not visit doctor or healthcare professional ^d	19.1 (16.7, 21.8)	61.0 (57.7, 64.2)	19.9 (17.3, 22.7)	29.5 (26.6, 32.6)
Metropolitan statistical area status				
Metro	19.3 (17.7, 21.0)	62.8 (60.7, 64.9)	17.9 (16.2, 19.7)	40.0 (38.0, 42.2)
Non-metro ^d	21.3 (17.0, 26.4)	59.4 (53.9, 64.7)	19.3 (15.4, 23.9)	39.0 (33.8, 44.4)
Children in household				
No Children ^d	16.0 (14.4, 17.6)	64.1 (61.8, 66.3)	20.0 (18.1, 21.9)	42.5 (40.3, 44.8)
Children aged 5 years	38.0 (29.9, 46.8)	50.0 (41.2, 58.8)	12.0 (7.3, 19.2)	43.5 (34.9, 52.6)
Children aged 6–17 years	26.3 (22.5, 30.6)	59.8 (55.3, 64.1)	13.9 (11.1, 17.3)	30.8 (27.0, 35.0)
High-risk condition status^g				
With high-risk conditions	22.4 (19.5, 25.5)	64.5 (61.0, 67.8)	13.2 (11.1, 15.6)	49.1 (45.6, 52.6)
Without high-risk conditions ^d	18.4 (16.6, 20.3)	61.3 (58.9, 63.7)	20.3 (18.3, 22.4)	35.8 (33.5, 38.2)

Note: Boldface indicates significance (p < 0.05 comparing to the reference group).

^a Adults who answered “all persons age 6 months and older” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have correct knowledge about the ACIP recommendation for influenza vaccination.

^b Adults who answered either “all persons age 13 years and older” or “only adults age 18 and older with chronic medical conditions” or “all persons age 6 years and older” or “persons of any age” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have awareness that there was a recommendation for influenza vaccination, but did not indicate correct knowledge of the recommended age group.

^c Confidence interval.

^d Reference level.

^e Annual household income.

^f Not Applicable.

^g Adults were considered having a high risk condition if they had ever been told by a doctor or other health professional that they had chronic asthma, a lung condition other than asthma, diabetes, heart disease (other than high blood pressure, heart murmur, or mitral valve prolapse), a kidney condition, a liver condition, obesity, sickle cell anemia or other anemia, a neurologic or neuromuscular condition that makes it difficult to cough, or a weakened immune system caused by chronic illness or by medicines taken for chronic illness such as cancer, chemotherapy, HIV/AIDS, steroids, and transplant medicines.

Table 4

Multivariable logistic regression analysis of factors associated with knowledge and awareness of the influenza vaccination recommendation and vaccination coverage among adults >18 years by demographic characteristics - United States, National Internet Flu Survey 2015.

	Knowledge ^a of influenza vaccination recommendation	Awareness ^b of influenza vaccination recommendation	Neither knowledge nor awareness of influenza vaccination recommendation	Early season influenza vaccination coverage
Characteristic	% (95% CI) ^c	% (95% CI)	% (95% CI)	% (95% CI)
Age				
18–49 years ^d	Reference	Reference	Reference	Reference
50–64 years	1.00 (0.79, 1.26)	1.00 (0.92, 1.09)	1.03 (0.82, 1.30)	1.17 (1.01, 1.35)
65 years and older	1.47 (1.13, 1.91)	0.90 (0.80, 1.02)	0.95 (0.70, 1.31)	1.64 (1.40, 1.93)
Gender				
Male ^d	Reference	Reference	Reference	Reference
Female	1.49 (1.25, 1.77)	0.99 (0.92, 1.05)	0.69 (0.57, 0.83)	1.05 (0.95, 1.16)
Race/ethnicity				
Non-Hispanic white only ^d	Reference	Reference	Reference	Reference
Non-Hispanic black only	0.67 (0.49, 0.92)	1.15 (1.05, 1.26)	0.86 (0.65, 1.15)	0.88 (0.74, 1.03)
Hispanic	0.91 (0.68, 1.21)	1.06 (0.95, 1.19)	0.94 (0.69, 1.29)	1.08 (0.92, 1.27)
Non-Hispanic, other or multiple races	0.78 (0.56, 1.08)	1.13 (1.02, 1.26)	0.80 (0.57, 1.12)	1.02 (0.85, 1.23)
Marital status				
Married/living with partner ^d	Reference	Reference	Reference	Reference
Widowed/divorced/separated	1.15 (0.92, 1.44)	0.96 (0.87, 1.06)	1.02 (0.80, 1.30)	0.99 (0.86, 1.14)
Never married	0.95 (0.73, 1.24)	1.02 (0.92, 1.12)	0.98 (0.74, 1.28)	0.88 (0.76, 1.03)
Education level				
High school or less ^d	Reference	Reference	Reference	Reference
Some college	1.10 (0.88, 1.37)	0.97 (0.89, 1.05)	1.02 (0.82, 1.28)	1.00 (0.88, 1.15)
College degree or higher	1.37 (1.10, 1.70)	0.93 (0.85, 1.01)	0.90 (0.71, 1.14)	1.32 (1.16, 1.49)
Employment				
Employed ^d	Reference	Reference	Reference	Reference
Unemployed	1.02 (0.65, 1.59)	1.10 (0.96, 1.26)	0.68 (0.43, 1.06)	0.96 (0.75, 1.24)
Not in work force	1.04 (0.84, 1.29)	0.95 (0.87, 1.04)	1.11 (0.87, 1.41)	0.93 (0.82, 1.06)
Annual income^e				
<\$35,000 ^d	Reference	Reference	Reference	Reference
\$35,000–\$49,999	1.36 (0.99, 1.86)	1.02 (0.90, 1.16)	0.71 (0.52, 0.98)	1.02 (0.85, 1.21)
\$50,000–\$74,999	1.15 (0.86, 1.52)	1.10 (0.99, 1.22)	0.67 (0.50, 0.89)	1.13 (0.97, 1.31)
\$75,000+	1.32 (1.00, 1.73)	1.05 (0.94, 1.16)	0.68 (0.53, 0.88)	1.03 (0.89, 1.18)
Region of residence				
Northeast ^d	Reference	Reference	Reference	Reference
Midwest	0.97 (0.75, 1.26)	0.95 (0.85, 1.05)	1.29 (0.96, 1.73)	1.00 (0.86, 1.17)

	Knowledge ^a of influenza vaccination recommendation	Awareness ^b of influenza vaccination recommendation	Neither knowledge nor awareness of influenza vaccination recommendation	Early season influenza vaccination coverage
South	1.08 (0.86, 1.36)	0.96 (0.87, 1.05)	1.08 (0.81, 1.43)	0.98 (0.85, 1.13)
West	0.97 (0.75, 1.26)	0.97 (0.88, 1.07)	1.16 (0.86, 1.56)	0.91 (0.78, 1.06)
Received influenza vaccination				
Yes	1.55 (1.31, 1.84)	1.04 (0.97, 1.11)	0.47 (0.37, 0.59)	NA ^f
No ^d	Reference	Reference	Reference	NA
Knowledge of recommendation for influenza vaccination				
Yes	NA	NA	NA	1.33 (1.19, 1.48)
No ^d	NA	NA	NA	Reference
Visit to healthcare professional/received recommendation/offer for influenza vaccination				
Doctor visit/received recommendation/offered influenza vaccination	0.84 (0.67, 1.07)	1.10 (1.01, 1.20)	0.87 (0.66, 1.13)	1.91 (1.69, 2.17)
Doctor visit/received recommendation/not offered influenza vaccination	1.01 (0.76, 1.33)	1.06 (0.94, 1.19)	0.82 (0.56, 1.20)	1.37 (1.15, 1.63)
Doctor visit/not received recommendation/not offered influenza vaccination	0.94 (0.77, 1.15)	1.03 (0.95, 1.12)	0.97 (0.78, 1.20)	1.04 (0.90, 1.20)
Did not visit doctor or healthcare professional ^d	Reference	Reference	Reference	Reference
Metropolitan statistical area status				
Metro	0.83 (0.66, 1.06)	1.04 (0.94, 1.16)	1.07 (0.82, 1.40)	0.98 (0.85, 1.14)
Non-metro ^d	Reference	Reference	Reference	Reference
Children in household				
No Children ^d	Reference	Reference	Reference	Reference
Children aged 5 years	2.63 (2.01, 3.43)	0.79 (0.65, 0.95)	0.46 (0.25, 0.82)	1.18 (0.95, 1.46)
Children aged 6–17 years	1.92 (1.57, 2.36)	0.90 (0.82, 1.00)	0.66 (0.50, 0.88)	0.87 (0.75, 1.01)
High-risk condition status^g				
With high-risk conditions	1.20 (1.01, 1.43)	1.02 (0.95, 1.10)	0.76 (0.60, 0.95)	1.15 (1.04, 1.28)
Without high-risk conditions ^d	Reference	Reference	Reference	Reference

Note: Boldface indicates significance (p < 0.05 comparing to the reference group).

^aAdults who answered “all persons age 6 months and older” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have correct knowledge about the ACIP recommendation for influenza vaccination.

^bAdults who answered either “all persons age 13 years and older” or “only adults age 18 and older with chronic medical conditions” or “all persons age 6 years and older” or “persons of any age” to the survey question, “Who do you believe the flu vaccine is recommended for” were considered to have awareness that there was a recommendation for influenza vaccination, but did not indicate correct knowledge of the recommended age group.

^cConfidence interval.

^dReference level.

^eAnnual household income.

^fNot Applicable

^gAdults were considered having a high risk condition if they had ever been told by a doctor or other health professional that they had chronic asthma, a lung condition other than asthma, diabetes, heart disease (other than high blood pressure, heart murmur, or mitral valve prolapse), a kidney condition, a liver condition, obesity, sickle cell anemia or other anemia, a neurologic or neuromuscular condition that makes it difficult to cough, or a weakened immune system caused by chronic illness or by medicines taken for chronic illness such as cancer, chemotherapy, HIV/AIDS, steroids, and transplant medicines.

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